

It extended over 270° of azimuth, and at 10.15 p. m. was very brilliant, with streamers reaching to the zenith. At Manchester, N. H., the display continued from 7 to 11 p. m. It consisted of an arch of a bright yellow color, about 10° in width, which extended from northwest over the northern horizon and to altitude 30° . At 8 p. m. streamers and "merry dancers" appeared, some of which shot upward to altitude 60° to 70° . The time of greatest brilliancy was 9.15 to 10 p. m., when the arch had disappeared, and the entire northern half of the sky was filled with beams and streamers of a bright yellow and green, with wavy circles of color in the zenith. After 10 p. m. the display began to fade.

At Northfield, Vt., an auroral arch of a whitish color, extending from east to west and to altitude 45° , was observed from 7.45 to 11 p. m. A brilliant aurora was observed at Boston, Mass., from 8 p. m. until midnight. It first appeared as a band of white light extending over 120° of azimuth and to altitude 40° . At 8.10 p. m. streamers were observed beginning in the northeast and moving westward; they were first visible below the arch, and thence extended upward and through it. From 10 to 11 p. m. brilliant streamers and waves of light flashed from the horizon to the zenith. At Woods Holl., Mass., the display was observed at 6.50 p. m. as a clearly defined white light, extending from east to west, and rising toward the zenith. It increased in brilliancy, with vertical bars of rose color. Later, waves of light moved back and forth and rose nearly to the zenith. The display began to fade 10.40 p. m. At New Haven, Conn., the aurora began 7.45 p. m. as a band of light about 2° in width, extending over 80° of azimuth, and to 30° altitude. At 8.20 p. m. streamers extended from the arch 20° to 30° towards the zenith. The time of greatest brilliancy was about 8.30 p. m.

At Oswego, N. Y., an arch of dim light reaching 30° altitude was observed at 6.40 p. m. At 6.55 p. m. the light was a yellowish white, with a rosy tint in the northwest. At 8.30 p. m. the arch extended to within about 5° of the zenith, with waves or flashes of light on the east and west sides and below the arch. The display was last observed 12.45 a. m., 6th, as a dim arch of 15° to 20° altitude resting on a very dark segment. At South Canisteo, N. Y., a light aurora extended from northwest to northeast and to altitude 35° at 8 p. m. It began to fade at 8.50 and disappeared at 9 p. m. At Red Wing, Minn., an aurora was observed from 10 p. m. until midnight; it was brightest at 11.40 p. m., when "merry dancers" extended from 150° to 200° azimuth, and rose to altitude about 25° .

At Bismarck, N. Dak., an aurora, consisting of bright, irregular beams, extending to altitude 40° to 50° , was observed from 7.30 to 9.50 p. m. At Fort Buford, N. Dak., a brilliant aurora consisting of 2 streamers of a bluish color in the northwest, extending about 30° above the horizon, was observed at 8.15 p. m. At 8.45 p. m. a band extended from northwest to east with many streamers, two of which were in the northeast and nearly reached the zenith. At this time the color changed gradually to a rosy hue, which was more pronounced 60° above the horizon. At 11 p. m. the display began to fade, and at 11.30 p. m. it had disappeared. At Miles City, Mont., a pale but plainly visible aurora consisting of a diffused light without motion, but with pale columns moving from the horizon

to an arch of altitude about 30° , was observed from 8 to 11.45 p. m.

At Fort Assinaboine, Mont., an aurora consisting of luminous beams of a pale yellow and reddish color rising to the zenith appeared 9 p. m. At 9.30 p. m. the display consisted of 3 arches, the upper one of which extended across the sky from west to east, and at 9.40 p. m. the arches assumed a serpentine shape, with beams of light. At 10.10 p. m., the arches were about 40° altitude and appeared as a brilliant curtain with a variety of colors. The display disappeared 10.30 p. m. At Olympia, Wash., an aurora consisting of 2 streamers of a rosy color reaching altitude 20° to 40° , and shorter streamers on either side, was observed 9.10 p. m. The display was last seen 11.15 p. m.

On the 28th an aurora was observed at Detroit, Mich., in the early morning. It was first seen at 5.20 a. m., when it extended from northwest to northeast and to altitude about 80° . It was a deep crimson color near the base, and rested on a bank of dark clouds; broad shafts of light rose to the zenith; the red color at the base faded into yellow and finally assumed a greenish tinge as the display waned; and at 7.30 a. m. (75th meridian time) the aurora disappeared.

On the 29th, at 3.40 a. m., a brilliant aurora was observed in the northern sky at Red Wing, Minn. "Merry dancers" appeared and finally formed into 4 distinct columns, which rose gradually to the zenith at 5.20 a. m. The display disappeared 5.45 a. m. On this date a brilliant aurora, extending from 100° to 250° of azimuth, was observed from 2 to 7 a. m. at Huron, S. Dak. It consisted of waving beams, some of which reached the zenith; at times the beams would disappear for several seconds; and at such times a bright purple arch was visible in the north. On the same date a brilliant aurora, extending from 175° to 225° of azimuth, was observed at Topeka, Kans., at 6.30 a. m. Streamers of great brilliancy extended to altitude 20° to 35° . The aurora had an apparent motion from west to east, and faded with the advancing daylight.

THUNDERSTORMS.

Description of the more severe thunderstorms reported for the month is given under "Local storms."

Thunderstorms were reported as follows: East of the Rocky Mountains they were reported in the greatest number of states, 11, on the 1st; in 7 on the 2d and 5th; in 6 on the 4th and 12th; in 5 on the 11th and 13th; in 3 on the 18th; in 2 on the 9th, 10th, 14th, 19th, 25th, and 30th; and in 1 on the 3d, 7th, 8th, and 31st. No thunderstorms were reported on the 4th, 15th to 17th, 20th to 24th, and 26th to 29th.

East of the Rocky Mountains thunderstorms were reported on the greatest number of dates, 10, in Louisiana; on 7 in Mississippi; on 6 in Alabama and Florida; on 5 in Georgia and Texas; on 3 in North Carolina and Tennessee; on 2 in Kansas, Massachusetts, Missouri, New York, Ohio, Pennsylvania, and South Carolina; and on 1 in Arkansas, Connecticut, Iowa, Maryland, Nebraska, New Jersey, and Wisconsin.

West of the Rocky Mountains thunderstorms were reported in Arizona on the 21st, and 28th to 30th; in Colorado on the 30th; and in New Mexico on the 28th, 30th, and 31st. In states and territories other than those named no thunderstorms were reported.

MISCELLANEOUS PHENOMENA.

MINERAL MATTER DEPOSITED WITH SNOW IN NORTHERN INDIANA, JANUARY 8, 1892.

Mr. Arthur Goss, of the Chemical Department of Purdue University, La Fayette, Ind., furnishes the following as the result of a chemical analysis of a sample of dark-colored mineral matter in the form of fine powder received at the University from Mr. N. W. Garman, of Rolling Prairie, Ind., who

stated that it fell with the snow of January 8th over an extended area in northern Indiana:

"Loss on ignition (water and other volatile matter)....	15.04
Silica (SiO_2).....	65.64
Aluminium (Al_2O_3) }	15.50
Iron (Fe_2O_3)..... }	
Lime (CaO)	2.19

Magnesia (MgO).....	1.38
Phosphoric acid (P ₂ O ₅).....	.10
TiO ₂ and loss (by difference)15
Total.....	100.00

"The entire absence of potash and the presence of a small

amount of titanium prove conclusively that it is not dust of a local origin; the absence of metallic iron ore and nickel shows that it is not of meteoric origin; and the low percentage of lime would indicate that it is not slag from an iron furnace. As it approximates very closely to some of the recorded analyses of lava (especially lava from the Pacific Ocean islands and Iceland) it is in all probability of volcanic origin."

STATE WEATHER SERVICES.

[Temperature in degrees Fahrenheit; precipitation, including melted snow, in inches and hundredths.]

The following extracts and summaries are republished from reports for January, 1892, of the directors of the various state weather services:

ALABAMA.

Temperature.—The mean was 1.8 below the normal; maximum, 77, at Curtis, 5th; minimum, 10, at Mountain Home, 6th, and at Valley Head, 7th; greatest monthly range, 58, at Florence; least monthly range, 39, at Chepultepec.

Precipitation.—The average was 2.15 above the normal; greatest monthly, 12.55, at Mount Willing; least monthly, 2.70, at Tuscumbia.

Wind.—Prevailing direction, northwest.—*P. H. Mell, Observer, Weather Bureau, Auburn, director.*

ARIZONA.

Temperature.—The mean was about normal in the central and eastern parts of the territory, while in the western part it ranged about 3.0 above; maximum, 80, at Red Rock, 25th; minimum, -11, at Flagstaff, 13th; greatest monthly range, 73, at Flagstaff; least monthly range, 38, at Gila Bend.

Precipitation.—The precipitation was unusually heavy, averaging about 1.00 above the normal; greatest monthly, 7.00, at Flagstaff; least monthly, 0.30, at Teviston.

Wind.—Prevailing direction, southwest.—*J. C. Hayden, Observer, Weather Bureau, Tucson, director.*

ARKANSAS.

Temperature.—The mean was 1.1 below the normal; maximum, 74, at Hot Springs, 29th; minimum, -14, at Rogers, 19th; greatest monthly range, 80, at Rogers; least monthly range, 43, at Newport.

Precipitation.—The average was 1.62 below the normal; greatest monthly, 5.59, at Greenville, Miss.; least monthly, 0.55, at Paragould.

Wind.—Prevailing direction, north.—*M. F. Locke, Commissioner of Agriculture, Little Rock, director; F. H. Clarke, Observer, Weather Bureau, assistant.*

COLORADO.

Temperature.—The mean was slightly above the normal; maximum, 71, at Lamar, 30th; minimum, -36, at Platoro, 13th; greatest monthly range, 94, at Julesburg; least monthly range, 54, at T. S. Ranch.

Precipitation.—The average was slightly above the normal, except in the central part; greatest monthly, 3.40, at Cimbras; least monthly, 0.00, at Sanborn and East Dale.—*W. S. Miller, Observer, Weather Bureau, Denver, director.*

FLORIDA.

Temperature.—Maximum, 83, at Manatee, 11th; minimum, 22, at Archer and Fort Meade, 4th; greatest monthly range, 60, at Archer; least monthly range, 26, at Key West.

Precipitation.—Greatest monthly, 8.72, at Pensacola; least monthly, 0.29, at Hypoluxo.

Wind.—Prevailing direction, northwest.—*E. R. Demain, Observer, Weather Bureau, Jacksonville, director.*

GEORGIA.

Temperature.—Maximum, 76, at Quitman, 12th; minimum, 9, at Diamond, 7th; greatest monthly range, 55, at Millen; least monthly range, 32, at Elberton.

Precipitation.—Greatest monthly, 12.59, at Canton; least monthly, 2.49, at Savannah.

Wind.—Prevailing direction, northwest.—*Park Morrill, Local Forecast Official, Weather Bureau, Atlanta, director.*

ILLINOIS.

Temperature.—The mean was 3.7 below the normal of the last 17 years; maximum, 62, at Cairo and Golconda, 1st; minimum, -25, at Philo, 15th and 20th.

Precipitation.—The mean was 0.70 below the normal of the last 14 years; greatest monthly, 2.70, at Mascoutah; least monthly, 0.30, at New Haven.

Wind.—Prevailing direction, northwest.—*John Craig, Observer, Weather Bureau, Springfield, director.*

INDIANA.

Temperature.—The mean was 2.7 below the normal; maximum, 62, at

Marengo, 29th; minimum, -22, at Marion, 20th; greatest monthly range, 78, at Marion; least monthly range, 55, at Michigan City.

Precipitation.—The average was 1.54 below the normal; greatest monthly, 2.43, at Vevay; least monthly, 0.69, at Shelbyville.

Wind.—Prevailing direction, southwest.—*Prof. H. A. Huston, La Fayette, director; C. F. R. Wappenhans, Local Forecast Official, Weather Bureau, assistant.*

IOWA WEATHER AND CROP SERVICE.

Temperature.—Maximum, 76, at Glenwood, 29th; minimum, -38, at Atlantic, 19th; greatest monthly range, 108, at Glenwood; least monthly range, 58, at Davenport.

Precipitation.—Greatest monthly, 3.13, at Fairfield; least monthly, 0.10, at Bancroft.

Wind.—Prevailing direction, northwest.—*J. R. Sage, Des Moines, director; G. M. Chappel, Local Forecast Official, Weather Bureau, assistant.*

KANSAS.

Temperature.—The mean was 1.1 above the normal; maximum, 81, at Shields, 26th; minimum, -34, at Seneca, 19th; greatest monthly range, 92, at Seneca; least monthly range, 69, at Altoona.

Precipitation.—The average was 0.27 below the normal; greatest monthly, 3.05, at Morse; least monthly, 0.02, at Shields.

Wind.—Prevailing direction, north.—*Prof. J. T. Lovewell, Topeka, director; T. B. Jennings, Observer, Weather Bureau, assistant.*

KENTUCKY.

Temperature.—The mean was about 3.0 below the normal; maximum, 65, at Earlington, 29th; minimum, -6, at Pellville, 15th; greatest monthly range, 68, at Earlington; least monthly range, 46, at Richmond.

Precipitation.—The average was about 1.50 below the normal; greatest monthly, 6.46, at Middlesborough; least monthly, 0.92, at Earlington.

Wind.—Prevailing direction, southwest.—*Frank Burke, Observer, Weather Bureau, Louisville, director.*

LOUISIANA.

Temperature.—The mean was 4.8 below the normal; maximum, 79, at Abbeville, 29th, and at Cameron, 30th; minimum, 9, at Winnborough, 19th and 20th; greatest monthly range, 66, at Winnborough; least monthly range, 44, at Port Eads.

Precipitation.—The average was 0.43 above the normal; greatest monthly, 10.20, at Abbeville; least monthly, 0.51, at Delhi.

Wind.—Prevailing direction, north.—*George E. Hunt, Local Forecast Official, Weather Bureau, New Orleans, director.*

MARYLAND.

Temperature.—Maximum, 70, at Kirkwood, Del., 14th; minimum, 0, at Boettcherville; greatest monthly range, 63, at Charlotte Hall; least monthly range, 42, at New Market.

Precipitation.—Greatest monthly, 6.54, at Fallston; least monthly, 1.87, at Taneytown.

Wind.—Prevailing direction, northwest.—*Dr. William B. Clark, Johns Hopkins University, Baltimore, director; Prof. Milton Whitney, Maryland Agricultural College, secretary and treasurer; C. P. Cronk, Observer, Weather Bureau, in charge.*

MICHIGAN.

Temperature.—The mean was 4.0 below the normal of the last 16 years; maximum, 57, at Birch Run, 1st; minimum, -26, at Adrian, 20th; greatest monthly range, 80, at Adrian; least monthly range, 40, at Charlevoix.

Precipitation.—The average was 0.12 below the normal of the last 16 years; greatest monthly, 7.10, at Atlantic; least monthly, 0.44, at Hillsdale.

Wind.—Prevailing direction, southwest.—*E. A. Evans, Local Forecast Official, Weather Bureau, Detroit, director.*

MINNESOTA.

Temperature.—The mean was slightly above the normal, except in the north-eastern part; maximum, 54, at Mankato, 29th; minimum, -44, at Crookston, 18th; greatest monthly range, 87, at Leech Lake and Winibigoshish; least monthly range, 69, at Saint Paul and Sheldon.